lunar surface illuminated by the light reflected from the earth, are reproduced in the March number of the *Bulletin de la Société astronomique de France*.

Whilst most people are familiar with the appearance of the moon thus partially illuminated, it is not an easy matter to photograph the phenomenon successfully, but on these photographs many lunar details are shown quite well, except in the sunlit crescent, which is, of course, much over-exposed.

The photographs were taken by M. Quénisset at the Juvisy Observatory, using the Viennet objective of 16 cm. aperture and 2·90 m. focal length, with ten minutes' exposure on a fast plate at the focus.

COSMICAL MATTER IN SPACE.—In his address as retiring president of the Royal Astronomical Society, Prof. Newall directed attention to, and briefly discussed, the possibility that the chief characteristic spectroscopic phenomena of the sun and the stars are mainly produced by matter streaming into these bodies from without rather than by matter brought from their interior layers to their radiating surfaces.

Appealing to various solar, cometary, and physical phenomena, Mr. Newall educed evidence that this view of astrophysics is not an obviously impossible one, and would, if found acceptable, account for several outstanding anomalies (Monthly Notices, R.A.S., vol. lxix., No. 4, February).

OBSERVATIONS OF VARIABLE STARS.—During 1908 Prof. Nijland observed, at the Utrecht Observatory, twenty-one Algol variables, six short-period variables, three variables of the U Geminorum type, SS Cygni, and forty-five long-period variable stars. The results of these observations now appear in No. 4309 of the *Astronomische Nachrichten*, together with a series of notes dealing with any special features observed.

THE CARNEGIE INSTITUTION OF WASHINGTON.

THE seventh year-book of the Carnegie Institution of Washington, for 1908, has just been received, and consists of reports of the president and the executive committee, and of directors of departments and other grantees who, with the assistance of the institution, have been carrying on investigations during the year.

The president's report gives the following facts and figures indicating the growth and extent of the work so far undertaken and accomplished by the institution. Since its organisation, in 1902, about 1000 individuals have been engaged in investigations under the auspices of the institution, and there are at present nearly 500 so engaged. Ten independent departments, each with its staff of investigators and assistants, have been established. In addition to these larger departments of work, organised by the institution itself, numerous special researches carried on by individuals have been subsidised. Six laboratories, for as many different fields of investigation and in widely separated localities, have been constructed and equipped. Work in almost every field of research, from archæology and astronomy to thermodynamics and zoology, has been undertaken, and the geographical range of this work has extended to more than thirty different countries.

At the end of the fiscal year, October 31, 1908, 120 volumes of researches in nineteen different fields of research, with a total of more than 30,000 pages, had been published, and twenty-seven volumes of researches were in the press. In addition to these publications issued by the institution, about 1000 shorter papers have been published in the current journals of the world by departmental investigators, by associates, and by assistants. The total amount of funds allocated for expenditure to November 1, 1908, was 737,000*l*., which included 59,000*l*. reverted and afterwards re-appropriated. The total amount expended was 672,000*l*.

During the past year the Nutrition Laboratory in Boston has been equipped, and systematic investigations are already in progress.

The construction of a building in Washington, D.C., at the south-east corner of Sixteenth and P Streets, N.W., was begun a year ago. This building is for administrative offices and the storage of records and publications, and when completed will cost about 44,000*l*.

The plans and specifications for the construction of a specially designed ship for ocean magnetic work have recently been completed. These plans require a non-magnetic sailing vessel with auxiliary propulsion. She will be classified as a yacht, will be called the *Carnegie*, and will, upon completion, proceed upon a magnetic survey of the Atlantic Ocean under the direction of the department of terrestrial magnetism of the institution. The grant for the construction of this vessel is 8000*l*.

A temporary observatory for supplementary measures of the positions of the fixed stars of the southern hemisphere is now being built at San Luis, Argentina, under the direction of Prof. Lewis Boss, head of the department of meridian astronomy of the institution. Prof. R. H. Tucker will be resident astronomer in charge of the work of observing and computing in South America, which will require three to five years for completion. The meridian instrument of the Dudley Observatory, the constants of which have been thoroughly investigated, will be transferred to San Luis and used in securing the desired measurements of the positions of stars in both hemispheres.

Work in the other departments of the institution has progressed rapidly and successfully. The investigations of Dr. G. E. Hale, director of the Solar Observatory on Mount Wilson, California, are of great interest. During the year, with the aid of his exceptional equipment, the discoveries which have been made with regard to sun-spots will probably prove of as great importance to terrestrial and molecular physics as to solar physics. The progress inaugurated may be confidently expected to lead rapidly to definite and important results. The expenditure on account of the site, buildings, instruments, and other appliances of the observatory was, up to September 30, 1908, 71,631*l*.

Under the direction of the department of historical research, work upon manuscript materials for American history has been pursued in France, Italy, and England, and next year will be extended to Germany. Many remarkable experiments and investigations are in progress under the department of botanical research at the Desert Laboratory at Tucson, Arizona.

In addition to the work carried on in the departments of the institution during the year, thirty-one grants were made to individuals and organisations in aid of researches conducted by them, and many other researches begun in former years have been carried forward. The publication of twenty volumes was authorised, and twenty-seven volumes and an atlas have been published. The latter include the report upon the California earthquake of April 18, 1906, a handbook of learned societies and institutions of North and South America, and a reproduction of the "Old Yellow Book," the source of Browning's "The Ring and the Book." These volumes and others issued by the institution are offered for sale at the cost of printing and transportation to purchasers.

At the annual meeting of the board of trustees on December 8, 1908, the sum of 127,260*l*. was allocated to carry on work of investigation, publication, and administration during the year 1909.

RECENT PAPERS ON DARWINISM.

THE *Fortnightly Review* for March contains an admirable article, by Dr. A. Russel Wallace, on "The World of Life, as Visualised and Interpreted by Darwinism." The veteran author argues with all his old vigour and eloquence in favour of the theory of the origin of species by natural selection, bringing out the facts of extensive and independent variation under natural conditions, emphasising the reality of the struggle for life, and insisting on the facts of adaptation as inexplicable under any other hypothesis than that of Darwin. He

shows how the commonest of the popular objections to the theory "rests upon the strange belief that variation is a rare phenomenon, that favourable variations occur singly and at long intervals, and, therefore, can have no effect in producing any important change"—an idea which is entirely at variance with the actual facts of nature. But while strenuously upholding the sufficiency of the Darwinian explanation of the phenomena of life within its own sphere, he still allows that "neither Darwinism nor any other theory in science or philosophy can give more than a secondary explanation of phenomena."

A paper by Mr. E. S. Russell in the Bologna *Rivista di Scienza*, entitled "The Evidence for Natural Selection," affords a good illustration of the tone, alternately patronising and depreciatory, which certain writers think fit to adopt in speaking of the epoch-making work of Darwin. After noticing several of the well-known cases in which the operation of natural selection has been actually demonstrated, and after so far giving his approval as to say that "the theory of natural selection . . . is a very suggestive and valuable one," the author thinks it sufficient to add that "it is highly probable that natural selection has played a part in evolution," and that it is "the formula of what seems to be a general process in nature, but it is a formula without much content." This is indeed to damn with faint praise. The paper concludes with the cryptic utterance that the theory "must become largely superseded by the very deepening of our knowledge of it."

Another paper in the *Rivista* by the same writer, on the "Transmission of Acquired Characters," contrives to introduce confusion into what is essentially a very simple issue. It is of great importance to know whether a modification induced upon the soma can be transmitted by inheritance; it is of comparatively little importance to know whether soma and germ can be affected in common by the same external agent, as, for example, by temperature in the case of cold-blooded animals like insects. The two ideas are essentially distinct, and nothing is to be gained by attempting to identify them.

Darwinism and Darwin loom large in other recent publications. The *American Naturalist*, for instance, contains five articles on these subjects, communicated, in the first instance, to a special Darwin memorial session held at Baltimore by the Botanical Society of America. In these Prof. W. Trelease discusses Darwin as a naturalist, and his work on cross-pollination in plants; Prof. F. E. Clements follows with an inquiry into the influence of Darwin in relation to the geography and ecology of plants; while Prof. H. M. Richards winds up with a review of Darwin's on plant-movements. In an independent article, which did not form part of the Baltimore meeting, Prof. E. Linton examines and criticises the "Origin of Species" in the light of recent observations and experiments.

To the March issue of *Himmel und Erde* Prof. Plate communicates a centenary eulogy on Darwin, originally delivered as a lecture at a festival meeting on Darwinism and evolution, held at the Royal Agricultary High School, Berlin. The *Zoologist* for March also has an article, by Prof. W. C. McIntosh, of St. Andrews, on the Darwinian theory in 1867 and now. This is a reprint, with interpolations, of a lecture given by the author in March of the year referred to before the Literary and Antiquarian Society of Perth. One passage in the original lecture, relating to "the appearance of the various species of Ichthyosaurus in the marine strata of the Chalk period, and the utter blank in reference to any form calculated to throw light on their origin," was incorrect when originally written, and now stands in urgent need of an explanatory paragraph in view of modern discoveries.

To the March number of *Rassegna Contemporanea* (published in Rome) Mr. Ugo Giovannozzi contributes an article on Darwin's life and works. The article is divided into sections, each dealing with separate periods of the career of the great evolutionist, special attention being directed to the influence of the voyage in the *Beagle* on his opinions, and to the appearance of the "Origin of Species." In the concluding paragraphs reference is made to Darwin's views on religion.

"Der gegenwartige Stand der Abstammungslehre" is the title of a pamphlet, by Prof. L. Plate, published in Berlin, which purports to be a popular explanation of the doctrine of evolution. After stating that evolution is supported by an overwhelming amount of evidence, and that no other theory is in existence capable of taking its place, and with a reference to its importance to mankind in general and to its bearing on religious belief, the author proceeds to state that, in his opinion, Darwin's selection-theory affords at present the only satisfactory explanation of the mode in which evolution has acted. The mutation-theory of de Vries, he adds, is not new in principle, but merely a restricted form of the selection-theory. Mutations are nothing more than pronounced variations, which Darwin called fluctuations or individualities.

THE ELECTRICAL PROPERTIES OF FLAME.[1]

WHEN a flame is brought near to an insulated conductor charged with electricity, the charge disappears. This is explained by supposing that the gases in the flame are partially dissociated into ions. A neutral molecule splits up into two ions, one having a negative charge and the other a positive charge. The conductor, if positively charged, attracts the negative ions out of the flame, and their charges when they reach it neutralise its charge.

When a plate of an insulator, such as ebonite, is placed between the flame and the charged conductor, the ions are still attracted through the plate, but when they reach it they cannot get through, and so remain on its surface. The side of the plate turned towards the flame thus gets a charge of opposite sign to that on the conductor. This shows that the disappearance of the charge in the first case was due to an opposite charge attracted out of the flame, and not to the charge on the conductor escaping into the flame.

We have a stream of gas rising from the flame, and the ions go up in the stream. The ions of opposite sign attract one another, and when two come together their charges are neutralised, and the two ions are said to have disappeared by re-combination. Thus as we go up in the stream of gas from the flame the number of ions diminishes. If the stream of gas is allowed to pass up a long tube containing along its axis a series of charged electrodes, then the bottom electrode will be discharged first, and then the next one, and so on. The ions are used up in discharging the electrodes, so that the electrodes are discharged in order, beginning with the lowest one. When the lower electrodes have been discharged, the upper ones begin to be discharged, but more slowly, because many of the ions disappear by re-combination before they get far up the tube. Another effect also comes in; as the gases cool down the ions do not move so freely through them, and are not so easily attracted by the electrodes. This makes the rate of discharge of the upper electrodes still slower.

Thus, as we go down towards the flame the number of ions and their mobility rapidly increases, and right inside the flame the number is so large that the flame behaves like a good conductor of electricity.

When the terminals of an induction coil are connected to two Bunsen burners, sparks can be passed from the tip of one flame to the tip of the other. The temperature of the flame is about 2000° C., so that the density of the gases in it is about one-seventh of their density at the ordinary temperature. The potential difference required to send a spark through the flame is about the same as that required to send a spark through an equal length of air at one-seventh of ordinary atmospheric pressure. It appears, therefore, that the ions do not make it easier for a spark to pass. This is due to the fact that the current in the spark is greater than the ions can carry, so that the potential difference has to be enough to produce more ions, and so is the same in the flame as in un-ionised air at the same density.

[1] Discourse delivered at the Royal Institution on Friday, February by Prof. H. A. Wilson, F.R.S.